**REMARKS**

The Office action of January 7, 2009, has been carefully considered.

Claims 14-15 and 17-27 now stand rejected under 35 USC 103(a) over Neuwirth et al and Tamamoto. Claim 14 has now been amended to incorporate the recitation of Claim 21, which has been canceled. Claim 14 therefore now recites both that the reinforcement exhibits triangular geometry in a section of the longitudinal axis, and is shaped symmetrically with respect to a symmetry plane in which the longitudinal axis runs.

It is alleged in the Office action that Neuwirth et al discloses a sonotrode having a head portion with at least one working surface which is substantially parallel to the longitudinal axis, a front surface which is substantially perpendicular to the at least one working surface and a back surface as shown in Figure 30. The limitation "for welding metal" has been disregarded on the basis that inclusion of the material worked upon by the apparatus does not impart patentability to an apparatus claim. It is moreover alleged that the working surface is capable of welding metal since the horn is made from suitable materials, and Neuwirth et al also discloses that the nature of the materials to be welded is not critical.

Those of ordinary skill in the art understand, however, that ultrasonic welding of plastic and metal are different processes, and different apparatus must be used for each. The ultrasonic welding of plastics takes place by generating sufficient heat to melt the plastics, whereas the ultrasonic welding of metals is primarily a mechanical process in which the metal is not melted, but rather is deformed in a cold working process.

The horn referred to in Figure 30, cited in the Office

action, is actually a well known prior art horn used for welding plastics, as also shown in Figure 17. See the Brief Description of the Drawings.

It is clear from Figure 17, that there is a large recess in the end of the horn extending well along the length of the horn. For this reason alone, the extension at the end of the horn cannot and does not serve as a reinforcement.

Moreover, the shape of the horn is in its self well known for welding plastics and is required for welding plastics. Submitted herewith is diagram labeled "Exhibit 1" which shows the geometry of this horn, compared with the geometry of a prior art horn used for welding metals, and a horn according to the invention (with front surface reinforcement) used for welding metals.

For the metal welding horns shown, the welding surfaces extend at approximately ½λ; for the plastics welding horn, the welding surfaces extend at approximately 3/4λ. This location of the welding surface in Neuwirth et al is confirmed at column 3, lines 54-55, in which it is stated that:

"[t]he entire length of the horn is equal to one-wavelength and the shorter distance from the center of the disk portion to the free or non-driven end of the horn is one-quarter wavelength."

Thus, the welding surface, the sonotrode at its maximum diameter, rests in the longitudinal node, the radial antinode, where radial displacement of the disk portion is at a maximum (column 3, lines 52-53).

This clearly differs from a metal welding horn, as described in Exhibit 2, attached, the Golde reference "Ultrasonic Metal Welding," page 28. As shown in this reference as well as in Exhibit 1, the length of the horn is ½λ, and the welding surface is at the longitudinal antinode.

In Neuwirth et al, the "pumping" is carried out at the

longitudinal node, the point at which radial movement is at a maximum, as discussed at column 3, line 65.

From Table 2 in column 18 of Neuwirth et al, it can be seen that the dimension of the disk-shaped portion, from which the welding surface extends, is 30 mm. The dimension is relevant with respect to the bond zone, since to achieve a uniform bond strength, the bond zone must lie in or substantially in the node of longitudinal oscillation, the region of maximum radial extension. Between the welding surface and the front surface of the sonotrode in Neuwirth et al, the sonotrode must have a length of $\lambda/4$ since otherwise, the sonotrode will not oscillate with the required resonance.

With respect to the triangular geometry, Tamamoto has been cited as showing an ultrasonic horn with a front surface 2100 having a triangular projection. In fact, as shown in Figure 3, the surface 2100 contains the *working surfaces 2110*, has two triangular projections, and is not at all symmetrical, in the sense that is presently claimed. Applicants submit that one of ordinary skill in the art would not substitute the geometry of Tamamoto for the front end of the Neuwirth et al sonotrode, given that the front surface of Neuwirth et al is not the working surface, but rather is the extension which results in a working surface at the correct location for welding plastics. The only reason to make such a combination would be the teaching of the present application.

Withdrawal of this rejection is requested.

In view of the foregoing amendments and remarks, Applicants submit that the present application is now in condition for allowance. An early allowance of the application with amended claims is earnestly solicited.

Respectfully submitted,

Ira J. Schultz
Registration No. 28666
Attorney for Applicants
(703)837-9600, ext. 23

EXHIBIT 1

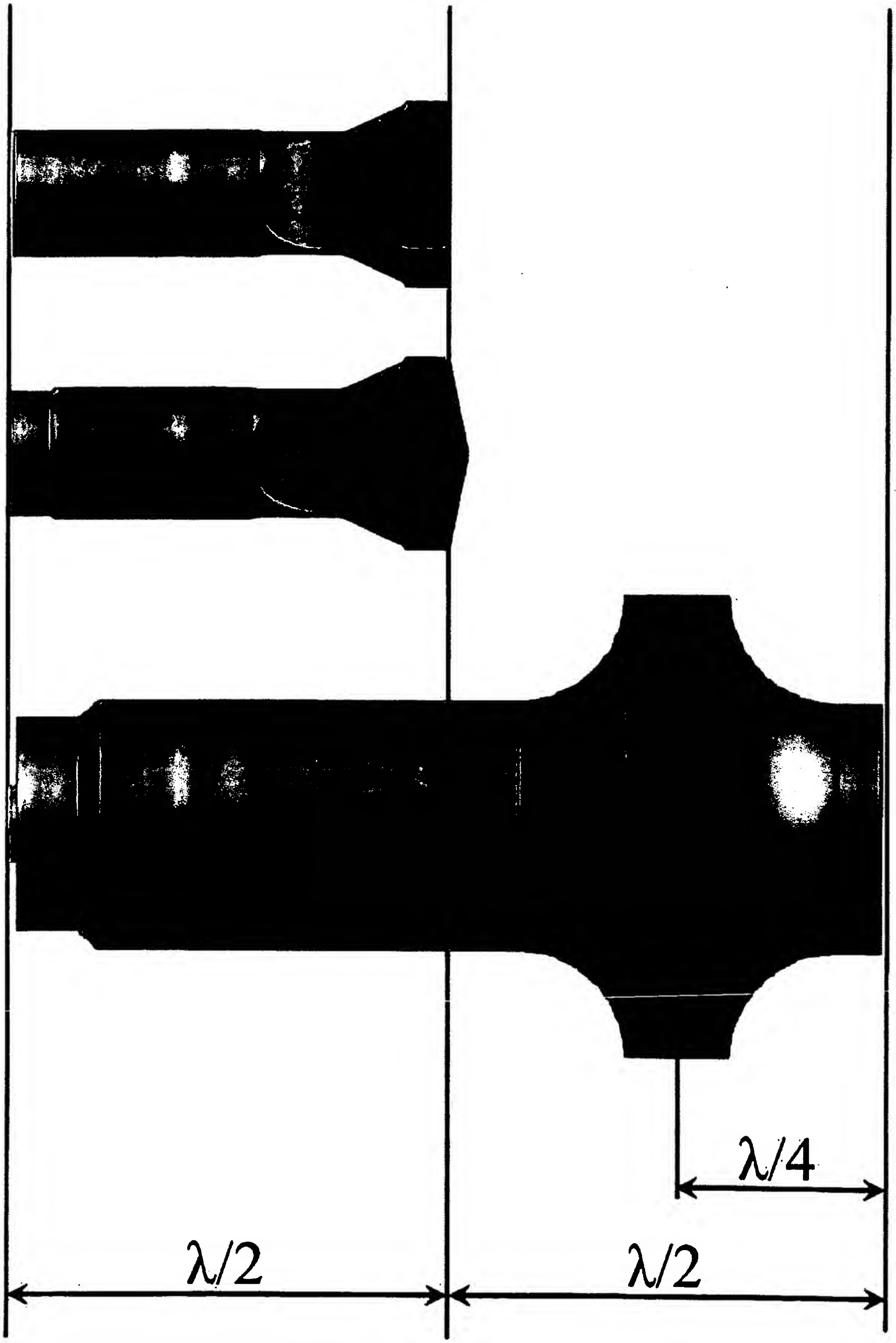
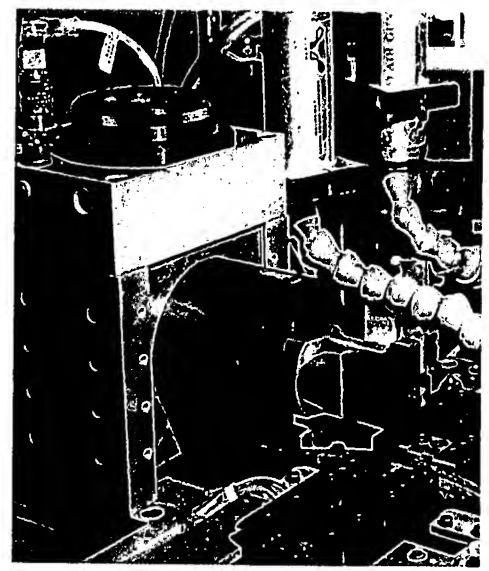


EXHIBIT 2

# Ultrasonic Metal Welding

**Principles and applications of high-grade bonding technology**

Hans-Dieter Golde



**verlag moderne industrie**

This book was produced with the technical collaboration of
STAPLA Ultraschall-Technik GmbH.



First published in Germany in the series
*Die Bibliothek der Technik*
Original title: *Ultraschall-Metallschweißen*
© 1995 by verlag moderne industrie

Illustrations: STAPLA Ultraschall-Technik
Typesetting: abc Media-Services, Buchloe
Printing and binding: Ludwig Auer, Donauwörth
Printed in Germany 930526

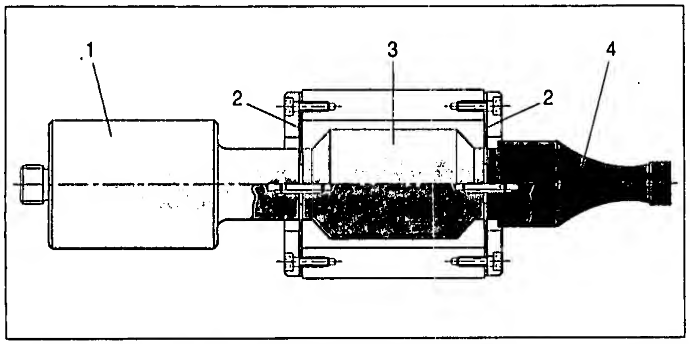
# Contents

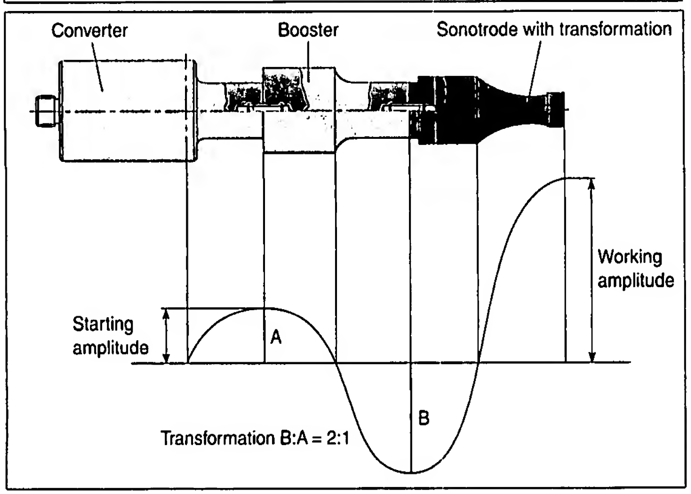
or clamped in the machine to prevent any uncontrollable movement and thus insure proper welding quality.

## The ultrasonic transducer system

The ultrasonic transducer system (fig. 18) consists of its components converter, booster and sonotrode.

*Fig. 18: Top: Transducer system of an ultrasonic spot-welding machine*
*Below: Amplitude development in the transducer system*






**The converter**

The converter (fig. 19) transforms the high-frequency electric energy produced by the generator into mechanical energy. In the past, ferromagnetic materials with magnetostrictive characteristics have been used for this purpose. Ultrasonic electrical frequency current induces a periodic alternating magnetic field inside the magnetostrictive material, which changes its dimensions as a function of the frequency of excitation.

**The use of piezoelectric effects**

Today, the reverse piezoelectric effect is almost exclusively used to produce oscillations. Piezoelectric materials periodically change under the effect of an electric alternating voltage. Highly efficient ring-shaped piezoceramics are used to transform electric energy into mechanical energy with an efficiency of approx. 95%. The ceramics are sintered from crystalline powder similar to the one used for the manufacture of china. The crystalline powder consists mainly of small crystallites with many so-called elementary cells which exist in the form of dipoles

*Fig. 19: Converter*